



WATER RESOURCES RESEARCH GRANT PROPOSAL

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Title: West-Wide Drought Forecasting System: A Scientific Foundation for NIDIS

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Principal Investigators: Steinemann, Anne; Lettenmaier, Dennis; Wood, Andrew (University of Washington)

Collaborators: Dettinger, Michael; Hanson, Randall (USGS)

Federal Funds: \$250,000

Non-Federal Matching Funds: \$250,000

Abstract: Drought is the costliest natural hazard in the U.S., averaging \$6-8 billion in damages annually (FEMA, 2004). The 1988 central U.S. drought alone cost almost \$62 billion (NCDC, 2006). Forecasts and real-time assessments of drought offer the potential to mitigate drought impacts. However, current drought monitoring systems for the western U.S. lack a predictive component for specific hydrologic indicators. Further, given that hydrologic impacts account for most drought losses, USGS data are essential to making drought forecasts useful.

We propose to develop a drought forecast and nowcast system for the western U.S., which will serve as a scientific framework for prediction and assessment of agricultural (soil moisture) and hydrologic (streamflow) drought in the region. This work, in collaboration with USGS personnel, will provide early warning capabilities and science-based indicators that are critical for the National Integrated Drought Information System (NIDIS), an effort of the Western Governors' Association (WGA), the National

Drought Mitigation Center (NDMC), NOAA, the USGS, and other agencies. Our work will also contribute to the U.S. Drought Monitor, which currently uses our National Surface Water Monitor, by incorporating USGS data into methods to characterize and forecast drought conditions, persistence, and recovery. Further, the PIs and their students will work directly with water managers in selected states in the region (Washington, California, and others) to apply this forecast system to water resources decisions.

Our proposed drought forecasting system will build upon the University of Washington's operational West-Wide Hydrologic Forecast System and National Surface Water Monitor. In doing so, we will extend the Variable Infiltration Capacity (VIC) macroscale hydrology model to utilize, via data assimilation methods, USGS hydrologic data in ways not currently exploited by prominent drought information services, such as the U.S. Drought Monitor.

Our specific objectives are to (1) implement a version of the VIC model that represents near-surface groundwater directly and thus can incorporate USGS well level data; (2) assimilate observations not presently used in the West-Wide system that are highly relevant to drought, such as USGS streamflow data from HCDN and similar stations, soil moisture information, and USGS well data; (3) produce probabilistic forecasts of drought persistence and recovery using ensemble prediction methods that incorporate climate forecasts out to one year; and (4) work with the WGA, the NDMC, and other users, such as state water agencies, to incorporate the resulting drought forecasts and nowcasts into drought information systems and water management decisions.

In addition to interactions with the WGA and the NDMC, we will work closely with Dr. Randall Hanson and Dr. Michael Dettinger of the USGS California Water Science Center in San Diego. Specifically, we will work with Drs. Hanson and Dettinger in (1) testing VIC predictions of well level anomalies at selected locations in California, (2) development of algorithms for assimilation of USGS well level and streamflow data, as well as other hydrologic data, into the drought forecasting system, (3) obtaining retrospective and real-time hydrologic data, and (4) validation of drought nowcasts and forecasts across the western U.S. study domain.

[U.S. Department of the Interior](#), [U.S. Geological Survey](#)

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